



# **ENSO Cycle: Recent Evolution, Current Status and Predictions**

**Update prepared by  
Climate Prediction Center / NCEP  
4 March 2013**



# Outline

- Overview
- Recent Evolution and Current Conditions
- Oceanic Niño Index (ONI) – **Revised March 2012**
- Pacific SST Outlook
- U.S. Seasonal Precipitation and Temperature Outlooks
- Summary



# Summary

## ENSO Alert System Status: Not Active

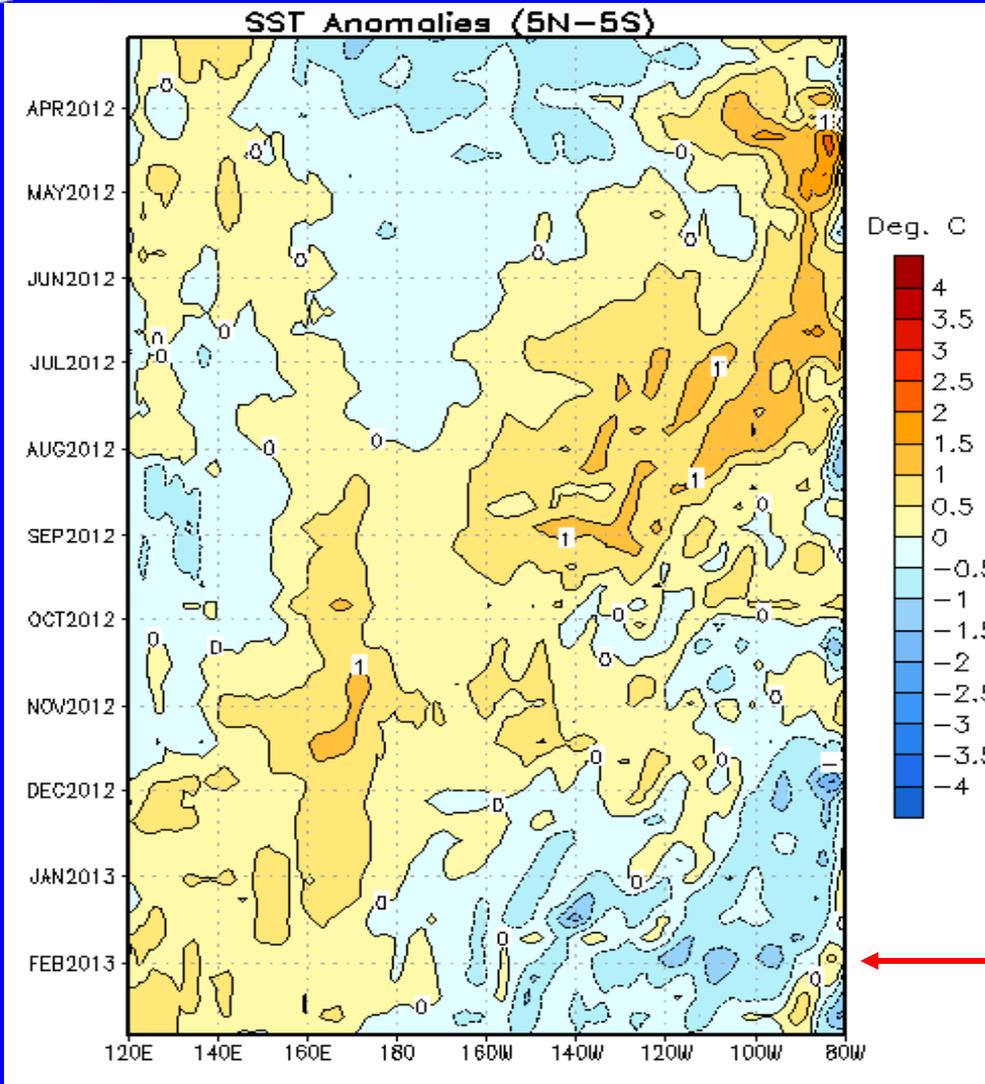
- **ENSO-neutral conditions continue.\***
- **Equatorial sea surface temperatures (SST) are near average to below average across the Pacific Ocean.**
- **Over the last couple months, the atmospheric circulation has been variable partially due to an active Madden-Julian Oscillation (MJO).**
- **ENSO-neutral is favored through Northern Hemisphere spring 2013.\***

\* Note: These statements are updated once a month in association with the ENSO Diagnostics Discussion:  
[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory)



# Recent Evolution of Equatorial Pacific SST Departures (°C)

Time



From June - October 2012, above-average SSTs were evident across most of the equatorial Pacific Ocean.

During January-February 2013, below-average SSTs were observed over the eastern half of the Pacific.

Longitude



# Niño Region SST Departures (°C) Recent Evolution

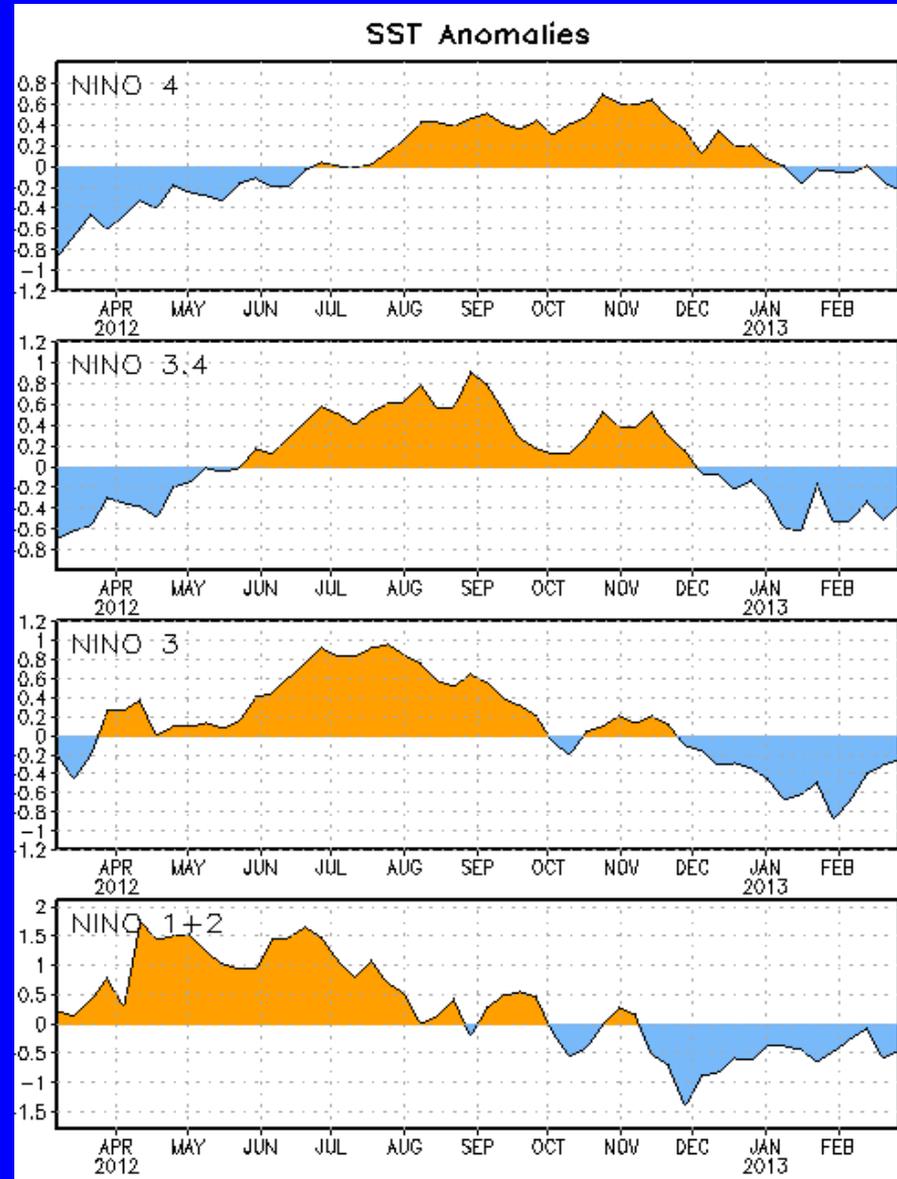
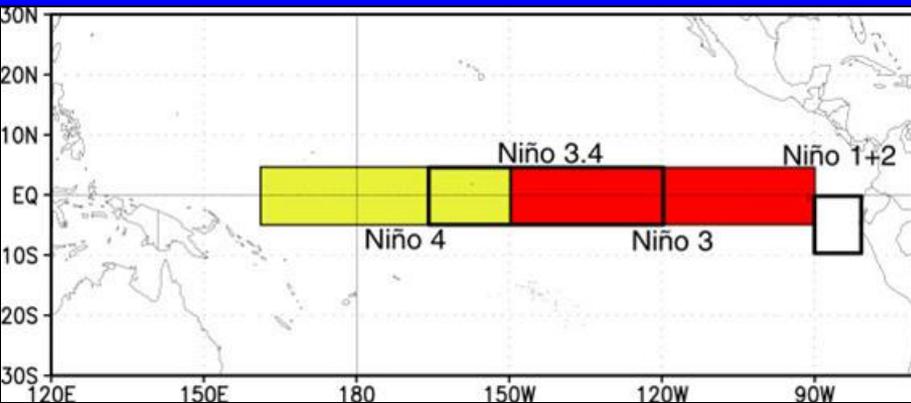
The latest weekly SST departures are:

Niño 4                    **-0.2°C**

Niño 3.4                **-0.3°C**

Niño 3                    **-0.2°C**

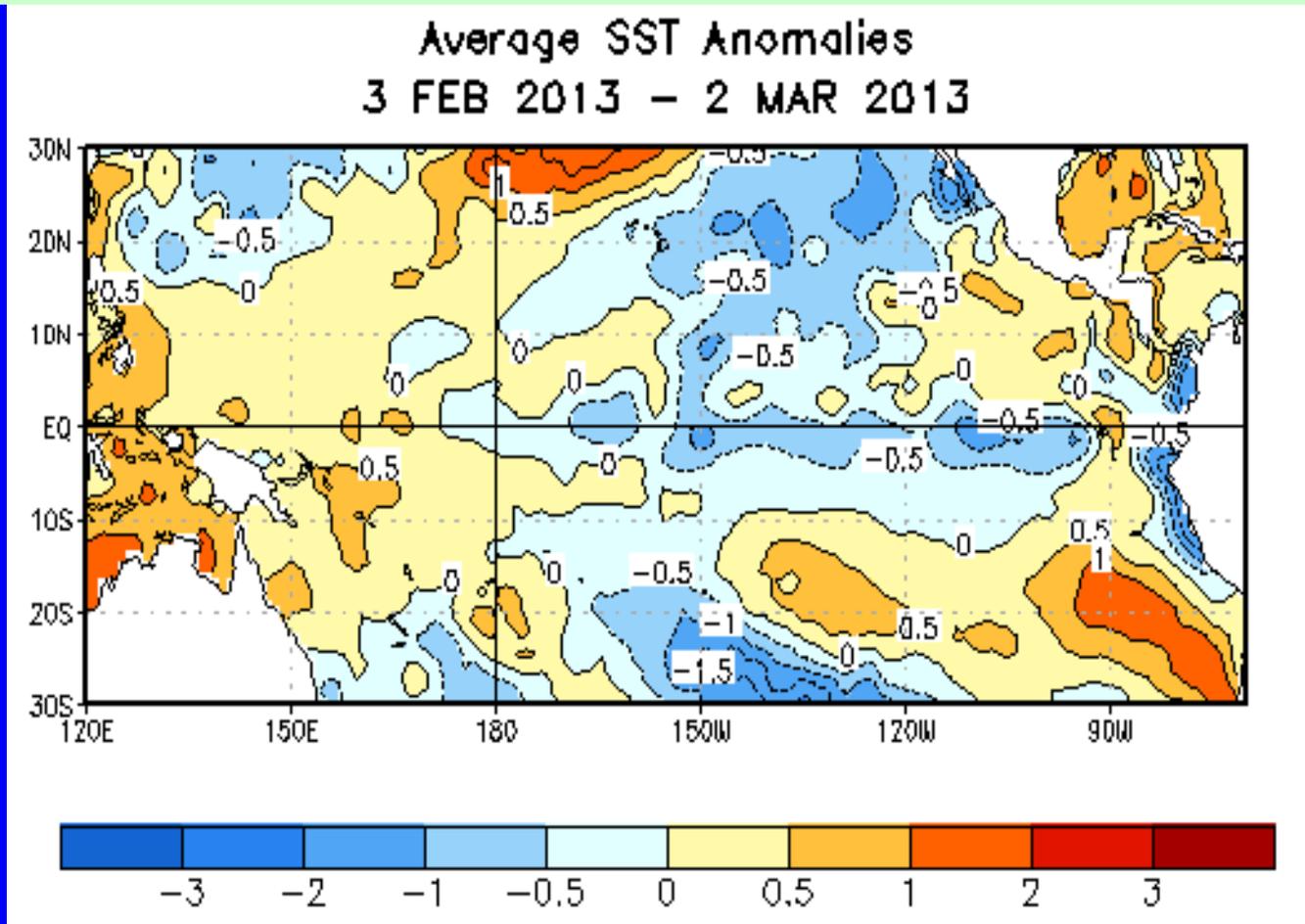
Niño 1+2                **-0.4°C**





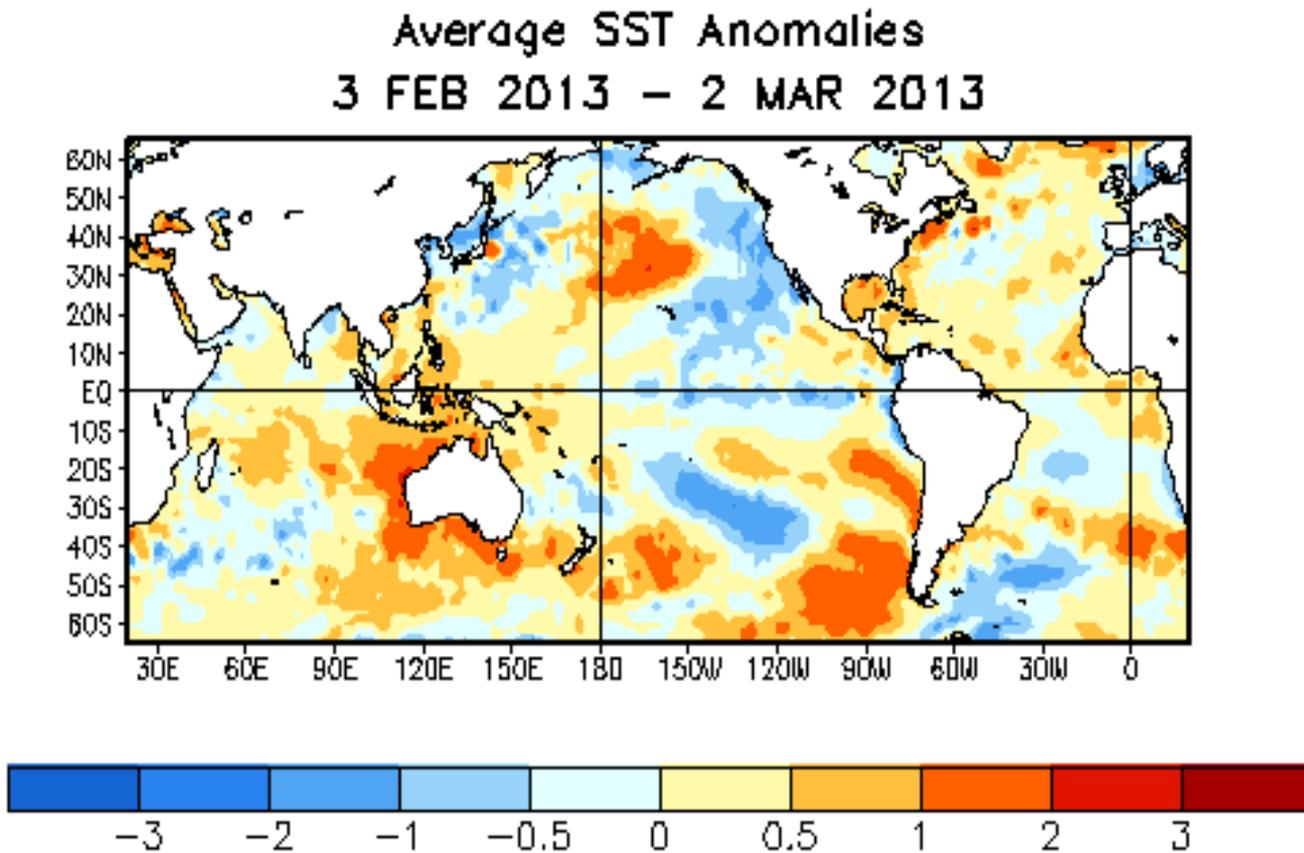
# SST Departures ( $^{\circ}\text{C}$ ) in the Tropical Pacific During the Last 4 Weeks

During the last 4-weeks, equatorial SSTs were more than  $0.5^{\circ}\text{C}$  below average across the eastern half of the Pacific Ocean.





# Global SST Departures (°C)



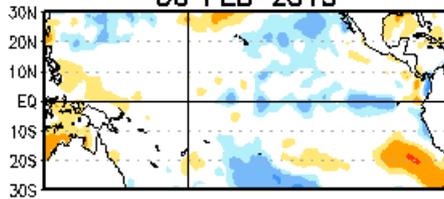
**During the last four weeks, equatorial SSTs were above average across the eastern Atlantic Ocean and near the Maritime Continent (north of Australia). SSTs were below average in the central and eastern Pacific Ocean.**



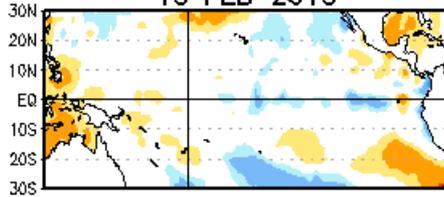
# Weekly SST Departures (°C) for the Last Four Weeks

Weekly SST Anomalies (DEG C)

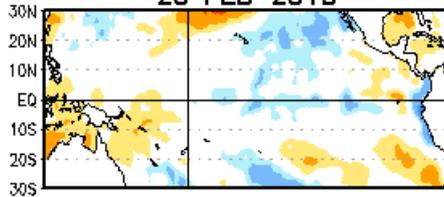
06 FEB 2013



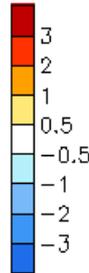
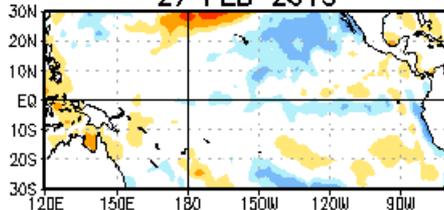
13 FEB 2013



20 FEB 2013



27 FEB 2013

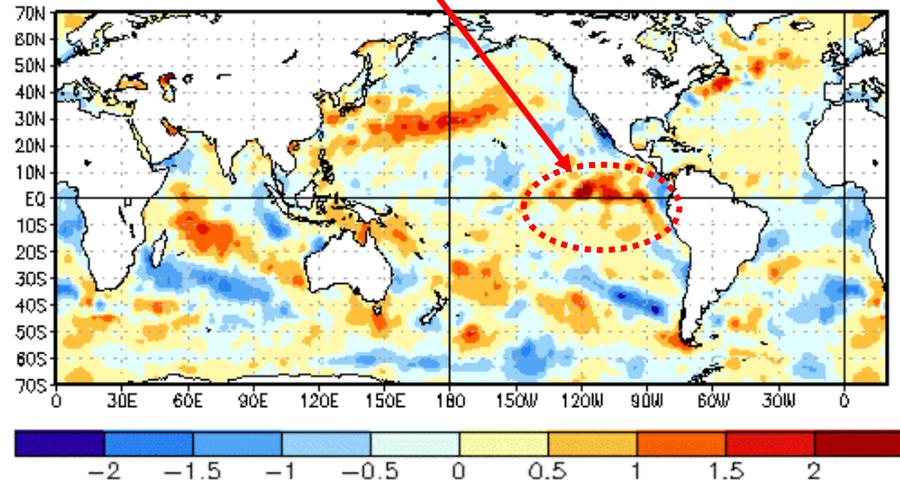


• During the last two months, below average SSTs have persisted in the eastern Pacific.

• Over the last month, the change in SST anomalies is positive in the eastern Pacific.

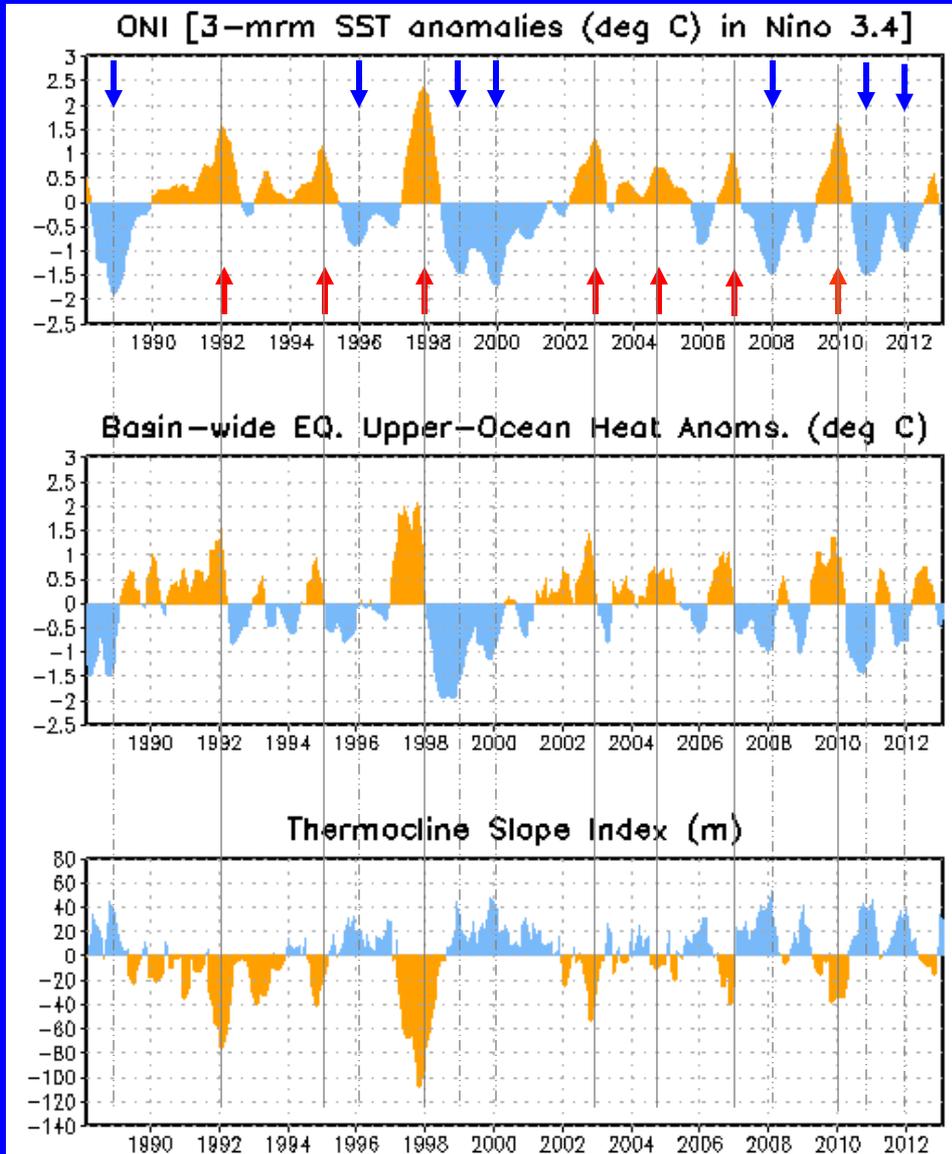
Change in Weekly SST Anoma (°C)

27FEB2013 minus 30JAN2013





# Upper-Ocean Conditions in the Eq. Pacific



Cold Episodes ↓  
Warm Episodes ↑

- The basin-wide equatorial upper ocean (0-300 m) heat content is **greatest** prior to and during the early stages of a Pacific **warm** (El Niño) episode (compare top 2 panels) and **least** prior to and during the early stages of a **cold** (La Niña) episode.

- The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

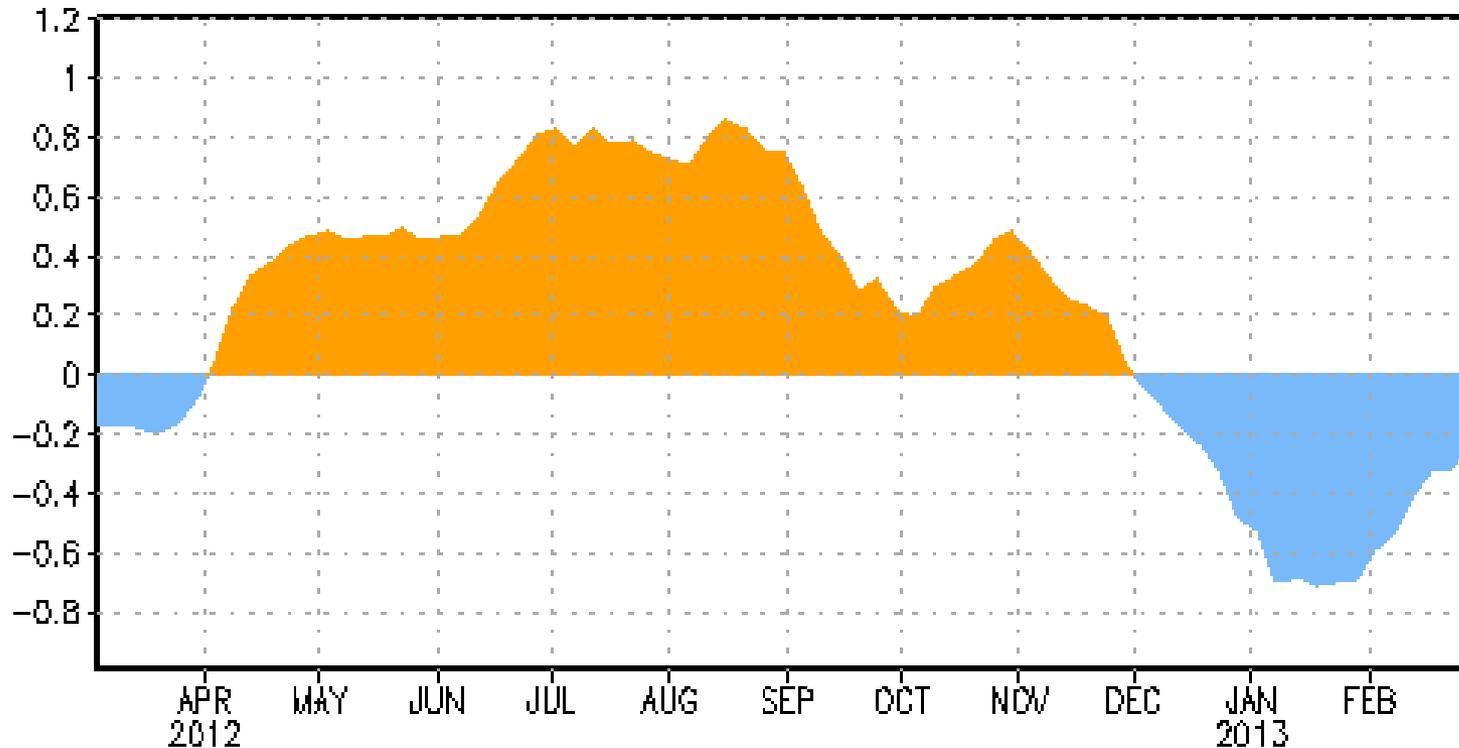
- Recent values of the upper-ocean heat anomalies (slightly negative) and a positive thermocline slope index reflect cool, ENSO-neutral conditions.

The monthly thermocline slope index represents the difference in anomalous depth of the 20°C isotherm between the western Pacific (160°E-150°W) and the eastern Pacific (90°-140°W).



# Weekly Central & Eastern Pacific Upper-Ocean (0-300 m) Average Temperature Anomalies

EQ. Upper-Ocean Heat Anoms. (deg C) for 180-100W



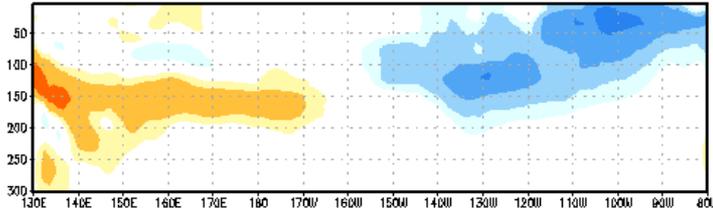
**From April - November 2012, the subsurface temperatures were above-average. Since November, anomalies have decreased, becoming negative in December 2012. During January 2013, the negative subsurface temperature anomalies remained nearly unchanged. Recently, subsurface temperature anomalies have increased.**



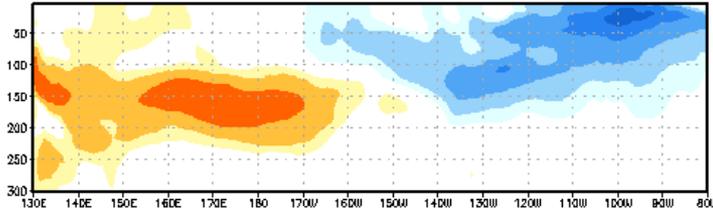
# Sub-Surface Temperature Departures (°C) in the Equatorial Pacific

EQ. Subsurface Temperature Anomalies (deg C)

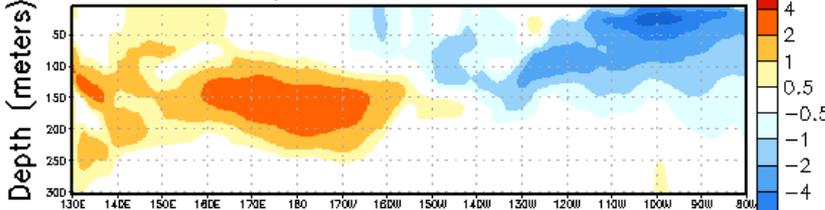
Three-pentad ave. centered on 08 JAN 2013



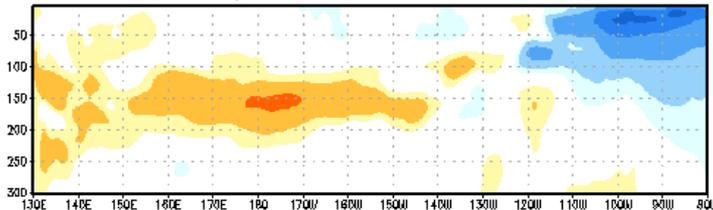
Three-pentad ave. centered on 23 JAN 2013



Three-pentad ave. centered on 07 FEB 2013



Three-pentad ave. centered on 22 FEB 2013



Time

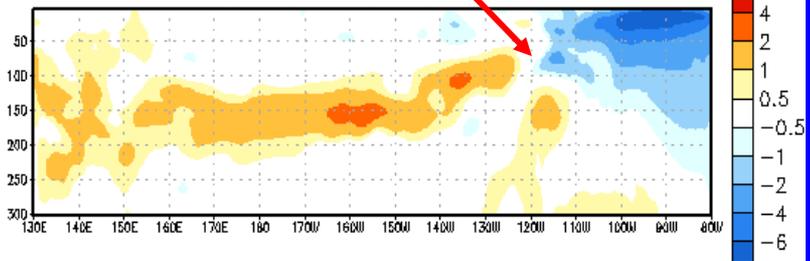


Longitude

- During January, negative subsurface temperature anomalies strengthened in the eastern Pacific.
- In the last two months, positive subsurface temperature anomalies have increased at depth in the western Pacific and have expanded eastward.
- Recently, the negative subsurface temperature anomalies have weakened in the eastern Pacific.

EQ. Subsurface Temperature Anomalies (deg C)

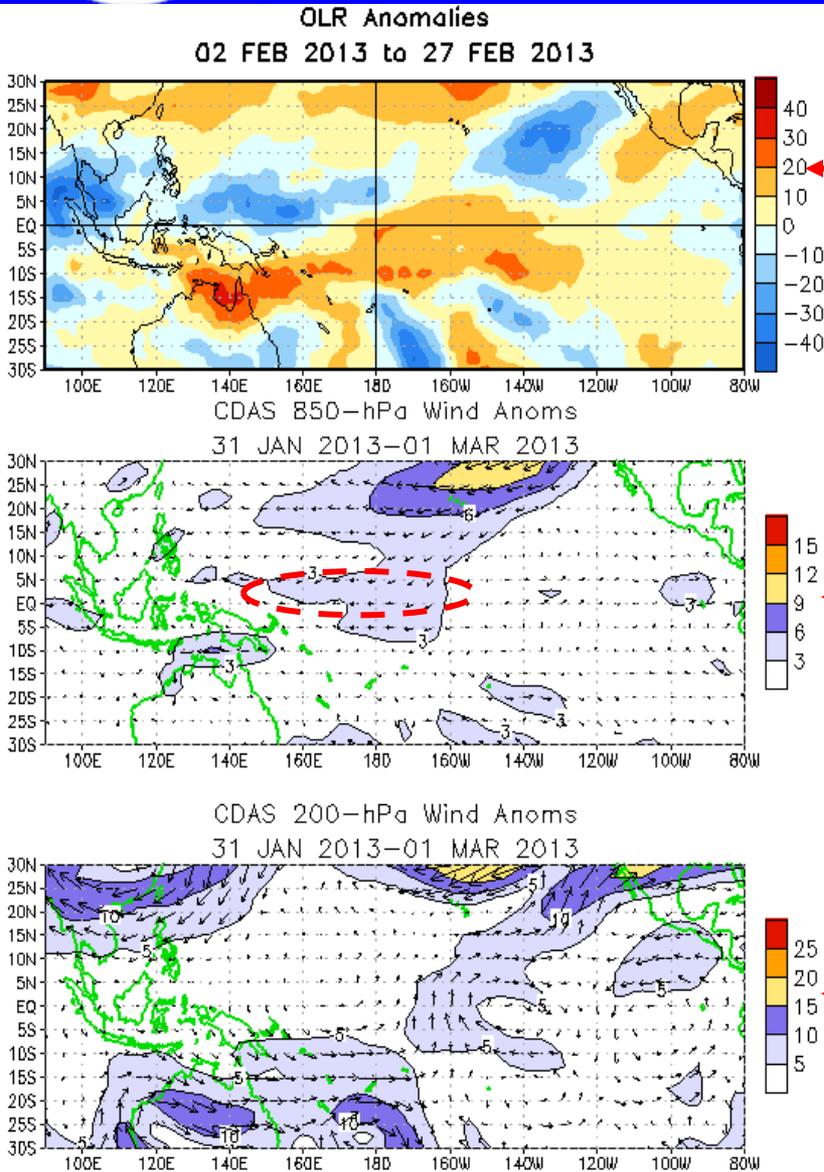
Pentad centered on 27 FEB 2013



Most recent pentad analysis



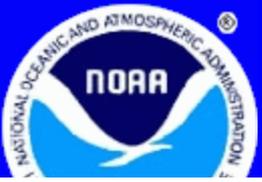
# Tropical OLR and Wind Anomalies During the Last 30 Days



Negative OLR anomalies (enhanced convection and precipitation, blue shading) were observed north of the equator, over the western Pacific. Positive OLR anomalies (suppressed convection and precipitation, red shading) were evident south of the equator, near Indonesia and northern Australia. Also, positive OLR anomalies were evident near and east of the Date Line.

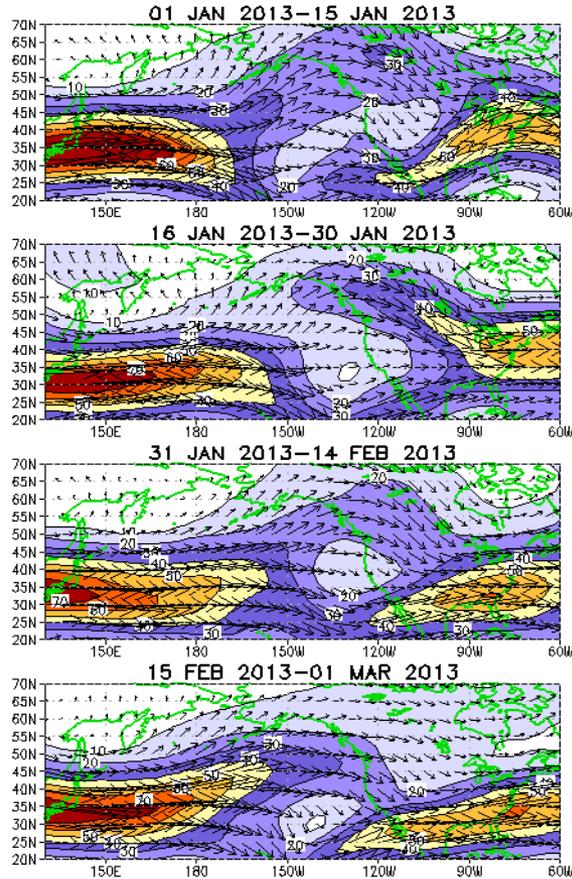
Low-level (850-hPa) wind anomalies were easterly over the west-central Pacific.

Anomalous cross-equatorial upper-level (200-hPa) winds were evident across the eastern half of the Pacific.

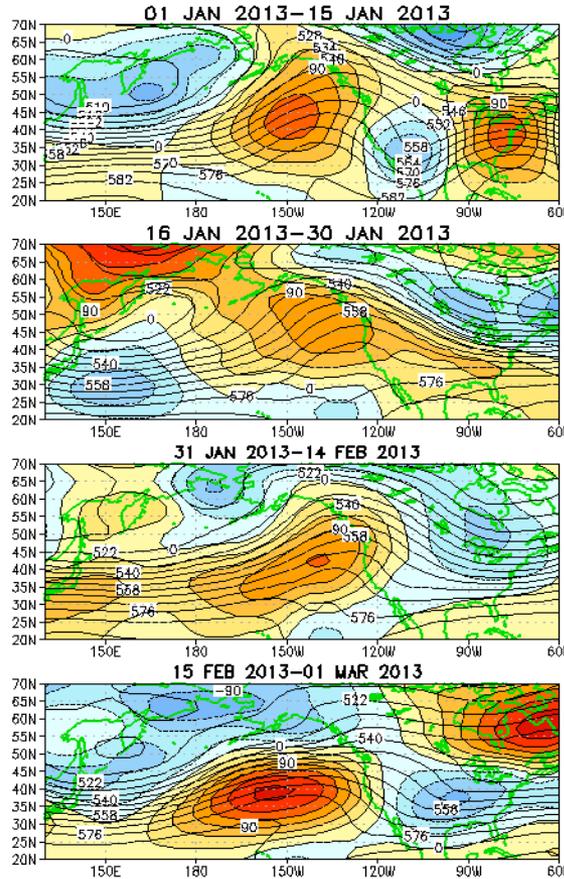


# Atmospheric Circulation over the North Pacific & North America During the Last 60 Days

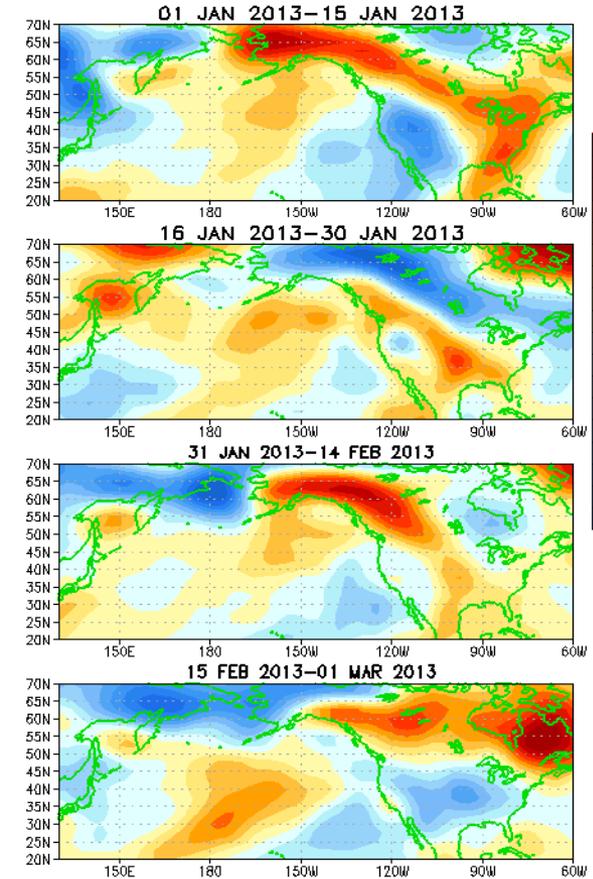
## 200-hPa Wind



## 500-hPa Height & Anoms.



## 925-hPa Temp. Anoms. (°C)



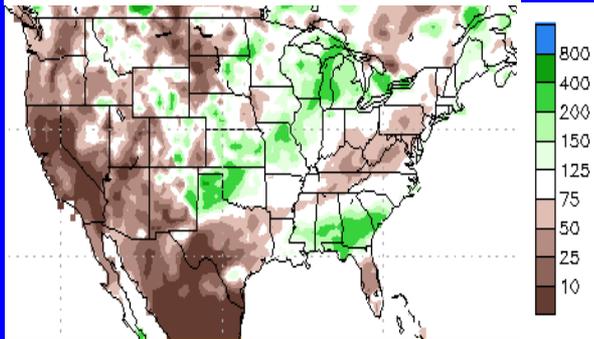
Since the beginning of January, an anomalous ridge has been evident over the eastern N. Pacific/ west coast of the U.S. Considerable variability in the height and temperature patterns over N. America has been observed downstream from the ridge.



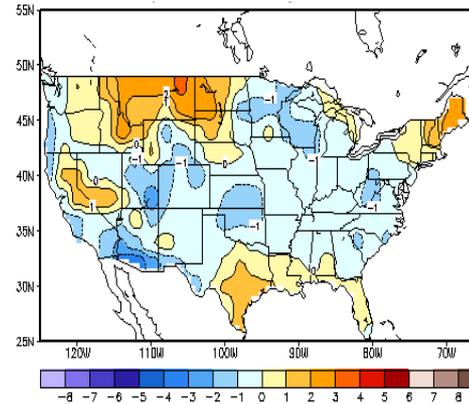
# U.S. Temperature and Precipitation Departures During the Last 30 and 90 Days

## Last 30 Days

30-day (ending 2 Mar 2013) % of average precipitation

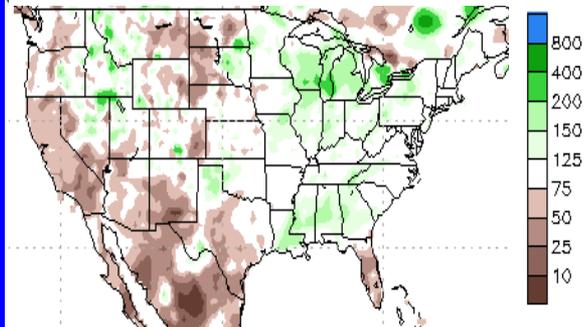


30-day (ending 2 Mar 2013)  
temperature departures (degree C)

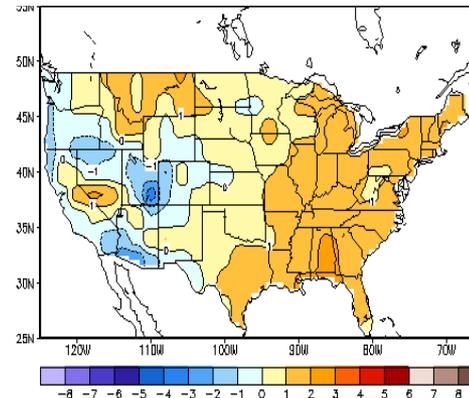


## Last 90 Days

90-day (ending 2 Mar 2013) % of average precipitation



90-day (ending 2 Mar 2013)  
temperature departures (degree C)



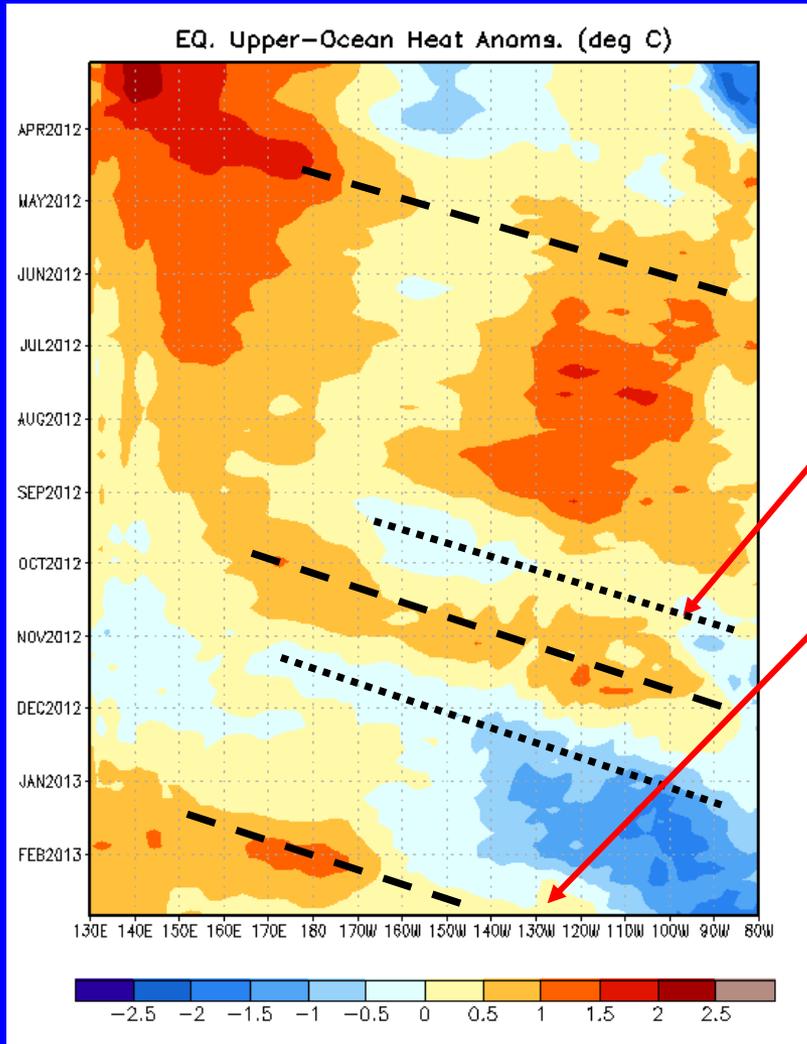


# Intraseasonal Variability

- **Intraseasonal variability in the atmosphere (wind and pressure), which is often related to the Madden-Julian Oscillation (MJO), can significantly impact surface and subsurface conditions across the Pacific Ocean.**
- **Related to this activity**
  - **significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.**



# Weekly Heat Content Evolution in the Equatorial Pacific



- From March- May 2012, heat content anomalies increased across much of the equatorial Pacific, partly in association with the downwelling phase of a Kelvin wave.

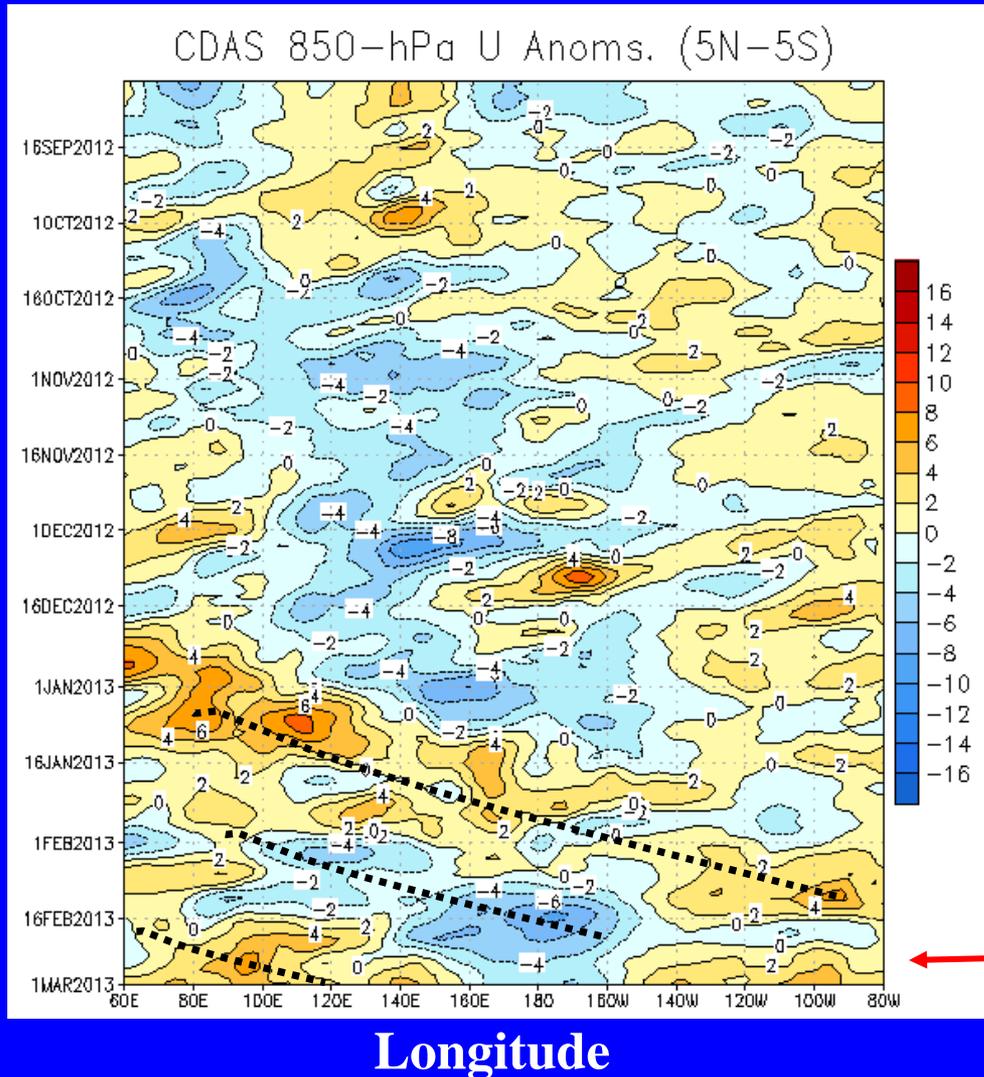
- Strong Kelvin wave activity was evident during September – December 2012.

- Recently, heat content anomalies have increased near the Date Line, while below average heat content has weakened in the eastern Pacific.

- Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.



# Low-level (850-hPa) Zonal (east-west) Wind Anomalies ( $\text{m s}^{-1}$ )



Westerly wind anomalies (orange/red shading).

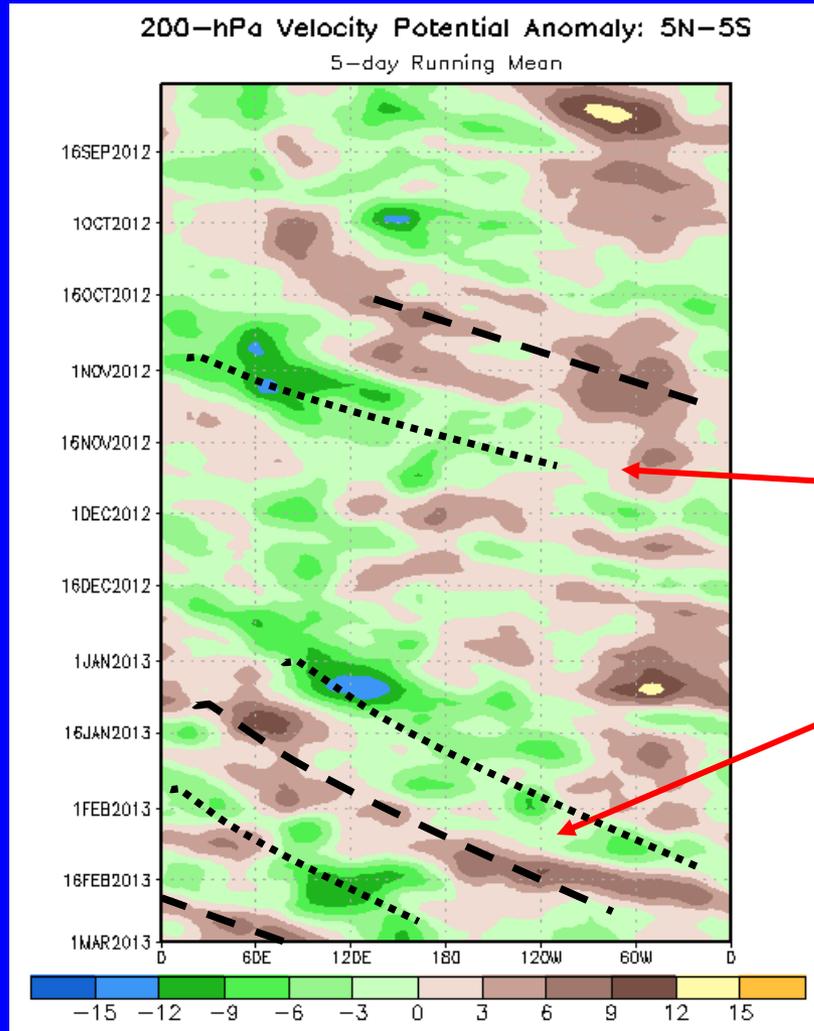
Easterly wind anomalies (blue shading).

During January-beginning of March 2013, the Madden Julian Oscillation (MJO) was evident in the eastward shift of easterly and westerly wind anomalies.

Currently, equatorial westerly wind anomalies are located near Indonesia, while easterly wind anomalies are evident near the Date Line.



# 200-hPa Velocity Potential Anomalies (5°N-5°S)



Positive anomalies (brown shading) indicate unfavorable conditions for precipitation.

Negative anomalies (green shading) indicate favorable conditions for precipitation.

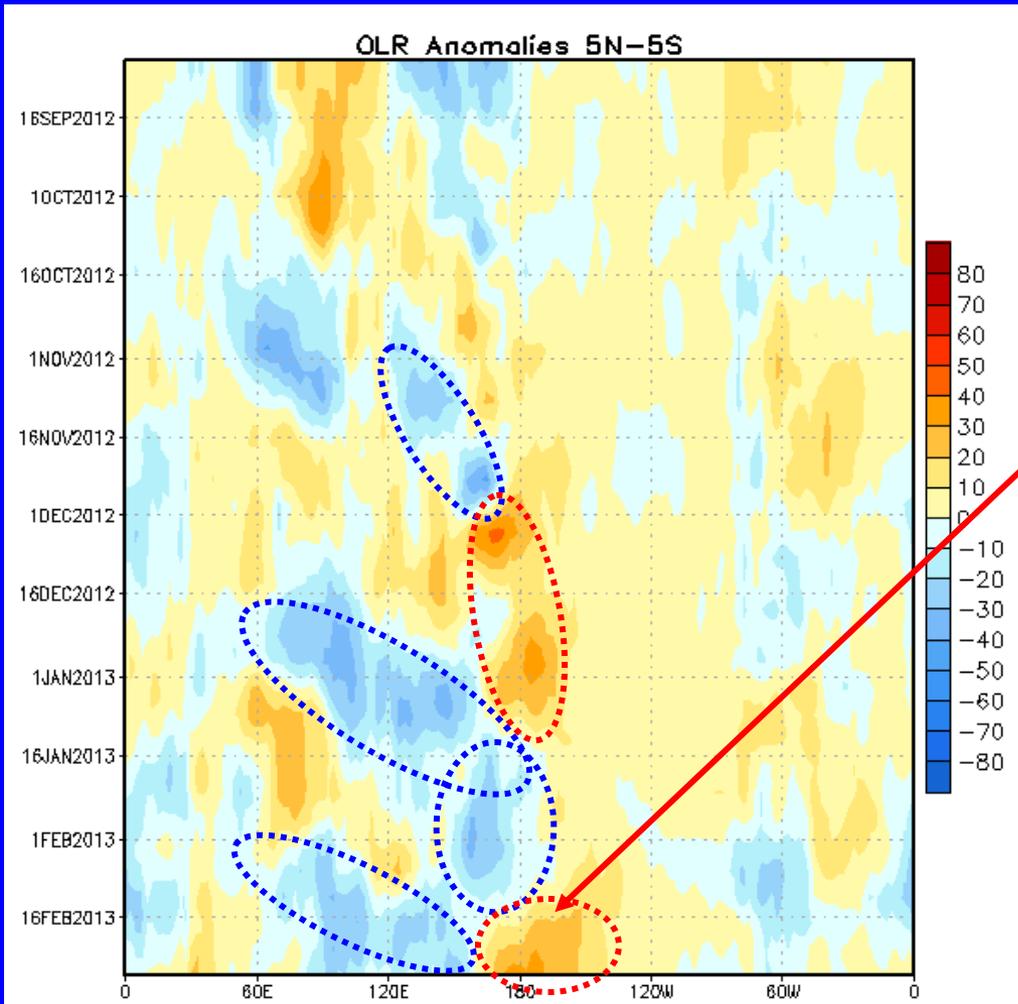
During mid October through mid November, a weak MJO was evident.

The Madden Julian Oscillation (MJO) emerged in early January and has continued into March 2013.



# Outgoing Longwave Radiation (OLR) Anomalies

Time



Longitude

**Drier-than-average conditions  
(orange/red shading)**

**Wetter-than-average conditions  
(blue shading)**

**Since mid-February 2013, above-  
average OLR is evident near the Date  
Line, while below-average OLR is  
observed over Indonesia and the  
western Pacific.**



# Oceanic Niño Index (ONI)

- The ONI is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.
- Defined as the three-month running-mean SST departures in the Niño 3.4 region. Departures are based on a set of improved homogeneous historical SST analyses (Extended Reconstructed SST – **ERSST.v3b**). The SST reconstruction methodology is described in Smith et al., 2008, *J. Climate*, vol. 21, 2283-2296.)
- Used to place current events into a historical perspective
- NOAA's operational definitions of El Niño and La Niña are keyed to the ONI index.



# NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a *positive* ONI greater than or equal to  $+0.5^{\circ}$  C.

La Niña: characterized by a *negative* ONI less than or equal to  $-0.5^{\circ}$  C.

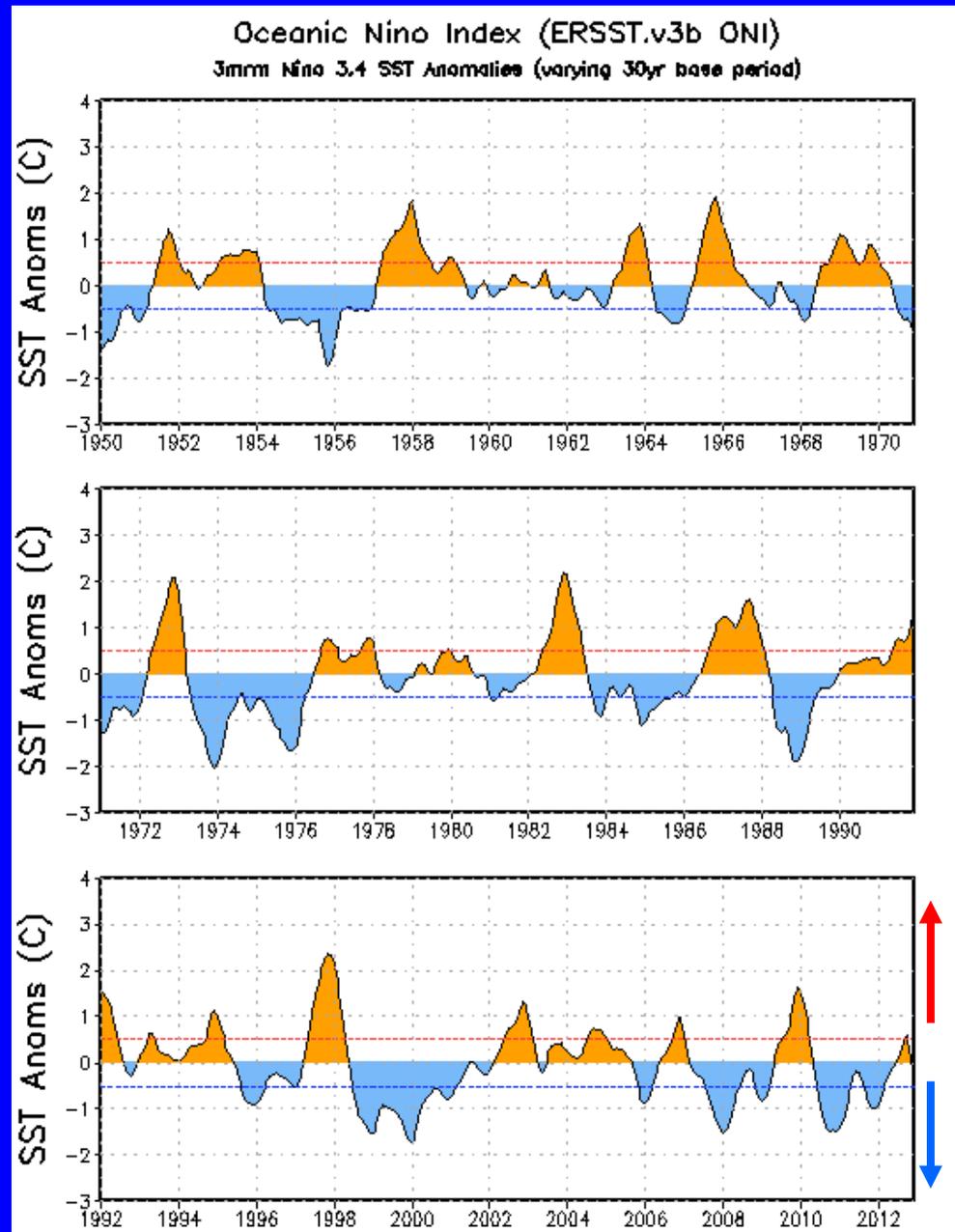
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

*CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed  $\pm 0.5^{\circ}$  C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.*



# ONI (°C): Evolution since 1950

The most recent ONI value (November 2012 – January 2013) is  $-0.3^{\circ}\text{C}$ .





# Historical El Niño and La Niña Episodes

## Based on the ONI computed using ERSST.v3b

<u>El Niño</u>	<u>Highest ONI Value</u>	<u>La Niña</u>	<u>Lowest ONI Value</u>
JJA 1951 – DJF 1951/52	1.2	ASO 1949 – JAS 1950	-1.4
DJF 1952/53 – JFM 1954	0.8	SON 1950 – JFM 1951	-0.8
MAM 1957 – JJA 1958	1.8	AMJ 1954 – NDJ 1956/57	-1.7
OND 1958 – FMA 1959	0.6	AMJ 1964 – DJF 1964/65	-0.8
MJJ 1963 – JFM 1964	1.4	JJA 1970 – DJF 1971/72	-1.3
AMJ 1965 – MAM 1966	1.9	AMJ 1973 – JJA 1974	-2.0
JAS 1968 – DJF 1969/70	1.1	SON 1974 – MAM 1976	-1.7
AMJ 1972 – FMA 1973	2.1	ASO 1983 – DJF 1983/84	-0.9
ASO 1976 - JFM 1977	0.8	SON 1984 – ASO 1985	-1.1
ASO 1977 – JFM 1978	0.8	AMJ 1988 – AMJ 1989	-1.9
AMJ 1982 – MJJ 1983	2.2	ASO 1995 – FMA 1996	-0.9
JAS 1986 – JFM 1988	1.6	JJA 1998 – FMA 2001	-1.7
AMJ 1991 – MJJ 1992	1.6	OND 2005 – FMA 2006	-0.9
ASO 1994 – FMA 1995	1.2	JAS 2007 – MJJ 2008	-1.5
AMJ 1997 – MAM 1998	2.4	OND 2008 – FMA 2009	-0.8
AMJ 2002 – JFM 2003	1.3	JJA 2010 – MAM 2011	-1.5
JJA 2004 – DJF 2004/05	0.7	ASO 2011 – FMA 2012	-1.0
ASO 2006 – DJF 2006/07	1.0		
JJA 2009 – MAM 2010	1.6		

**NOTE (Mar. 2012):**

**The historical values of the ONI have slightly changed due to an update in the climatology. Please click here for more details on the methodology:**

[Historical ONI Values](#)

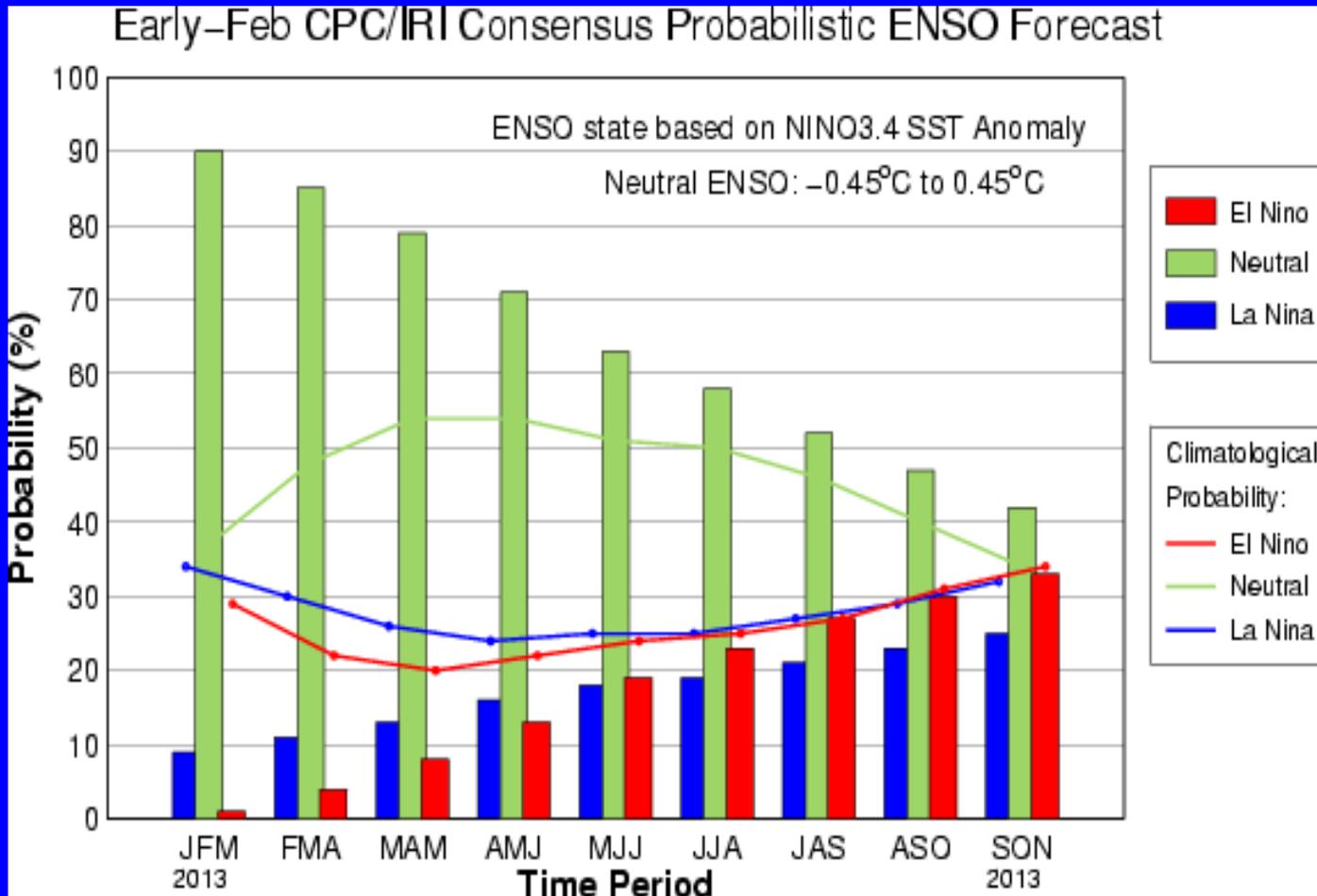




# CPC/IRI Probabilistic ENSO Outlook

(updated 7 Feb 2013)

**ENSO-neutral is favored into Northern Hemisphere fall 2013.**





# Pacific Niño 3.4 SST Outlook

- Most models predict the persistence of current Niño-3.4 values, with ENSO-neutral (-0.5°C to +0.5°C) continuing through the Northern Hemisphere summer 2013.

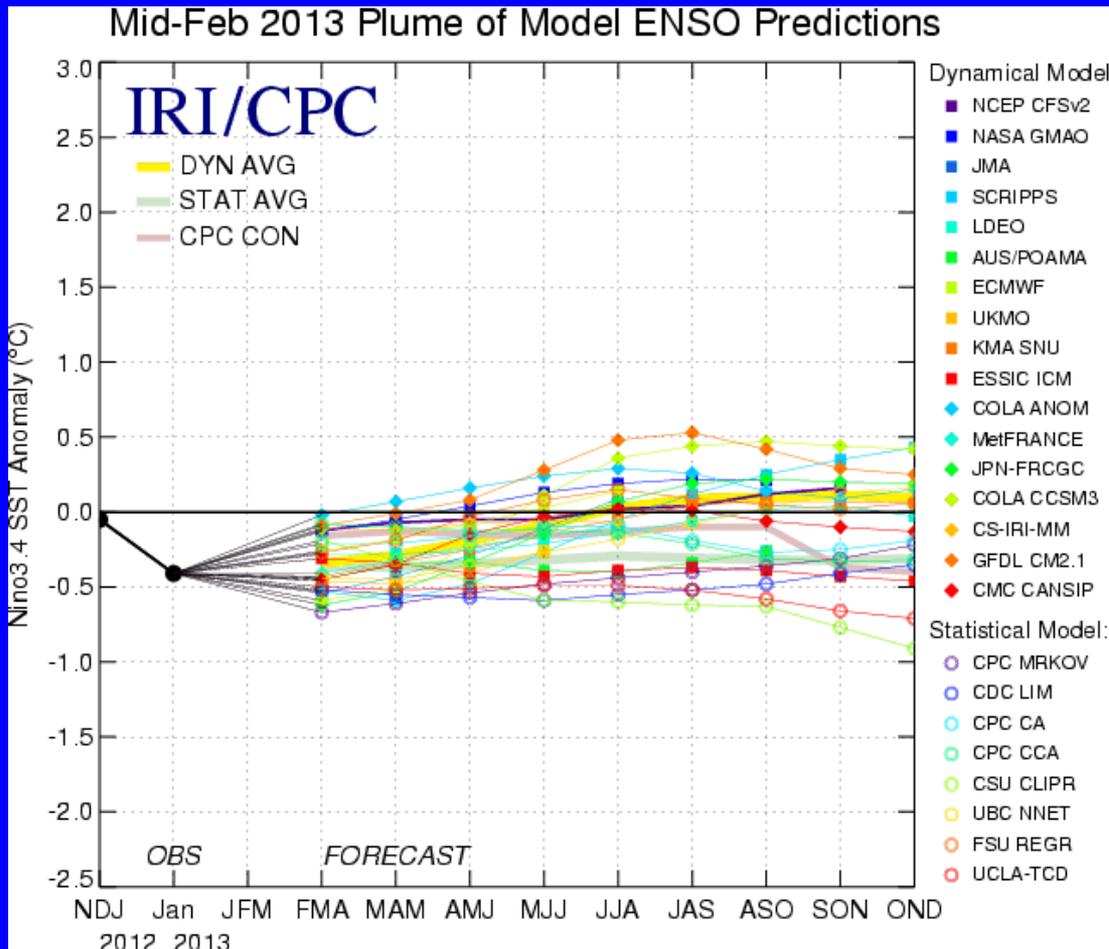


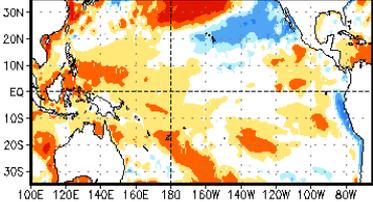
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 Feb 2013).



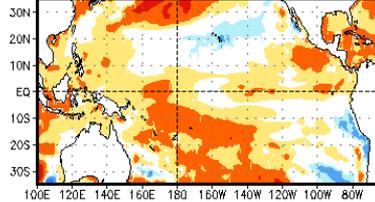
# SST Outlook: NCEP CFS.v2 Forecast

## Issued 3 March 2013

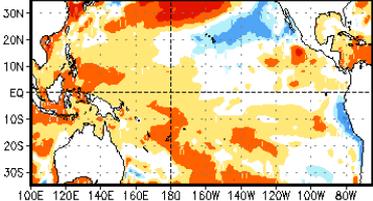
Mar-Apr-May 2013



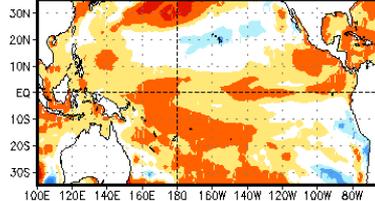
Jul-Aug-Sep 2013



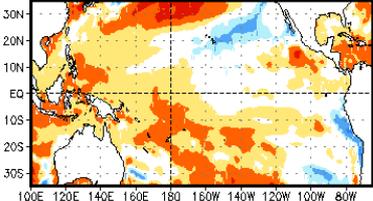
Apr-May-Jun 2013



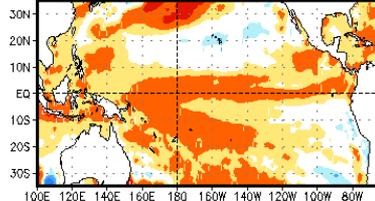
Aug-Sep-Oct 2013



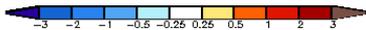
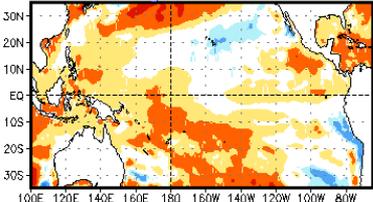
May-Jun-Jul 2013



Sep-Oct-Nov 2013



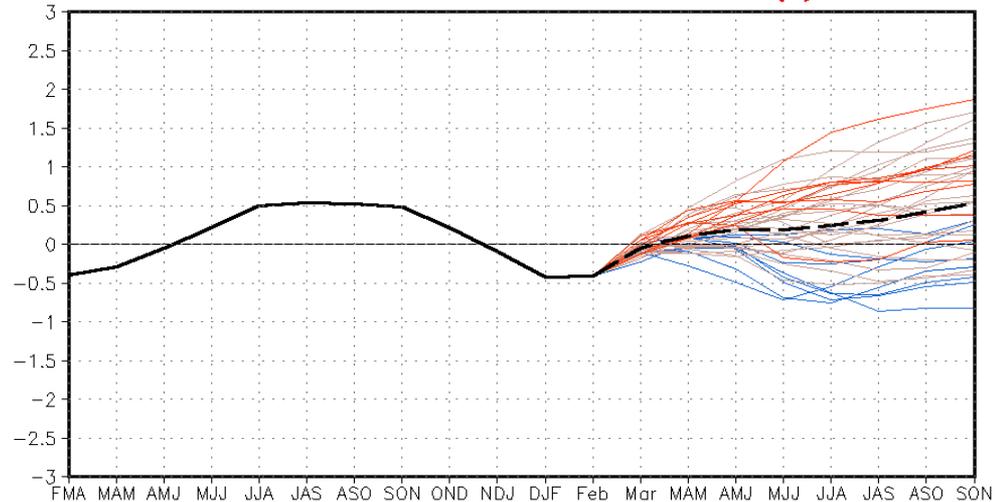
Jun-Jul-Aug 2013



(Model bias correction base period: 1999–2010; Climatology base period: 1982–2010)

The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral conditions through the Northern Hemisphere summer 2013.

CFSv2 forecast Nino3.4 SST anomalies (K)

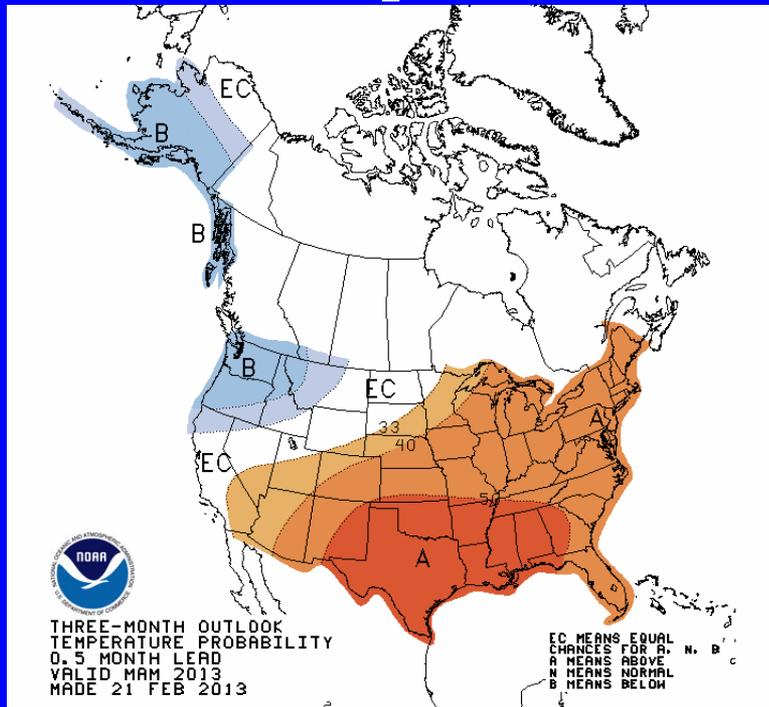




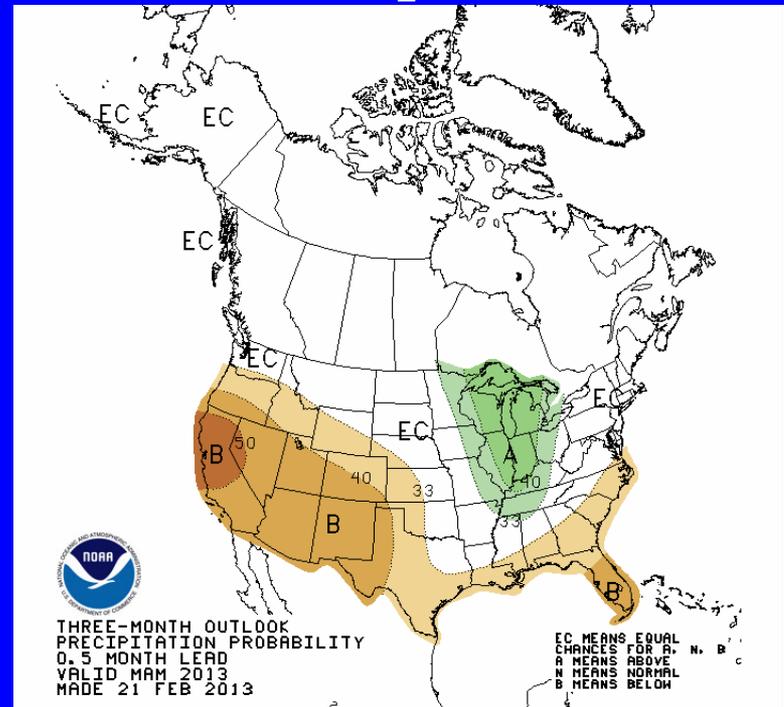
# U. S. Seasonal Outlooks

## March – May 2013

### Temperature



### Precipitation



**The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.**



# Summary

## ENSO Alert System Status: Not Active

- **ENSO-neutral conditions continue.\***
- **Equatorial sea surface temperatures (SST) are near average to below average across the Pacific Ocean.**
- **Over the last couple months, the atmospheric circulation has been variable partially due to an active Madden-Julian Oscillation (MJO).**
- **ENSO-neutral is favored through Northern Hemisphere spring 2013.\***

\* Note: These statements are updated once a month in association with the ENSO Diagnostics Discussion:  
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